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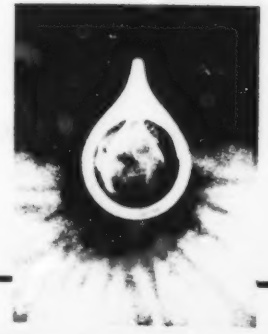

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Education and Training in the Third World *

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ABSTRACT

The All-India Co-ordinated Project for Dryland Agriculture was one of the Canadian International Development Agency's most successful projects in south-east Asia. Some of this success was due to the education and training associated with the project. Training consisted of my working as a Canadian advisor with Indian counterparts and the training of Indian scientists in Canada. Various techniques were employed to educate and train them to solve problems (pertinent to the overall goals) of soil and water management for dryland agriculture.

Another aspect of the project provided a training opportunity for Canadian and Indian scientists. Both were exposed to first-class research in other countries.

The formal education of potential research scientists from the developing countries at foreign universities is discussed based on experiences in India, Sri Lanka and Brazil.

INTRODUCTION

Canada provides technical assistance to developing countries through agencies such as the Canadian International Development Agency (CIDA) and the International Development Research Corporation (IDRC). Much of the assistance is directed to training and education. Based on experiences in India, Sri Lanka, and Brazil, some aspects of training have been very positive. However, there is an ongoing need to examine the process to ensure that benefits are being optimized.

This paper will review aspects of the training and education associated with these projects and discuss opportunities for improvement.

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INDIA EXPERIENCE

The All-India Co-ordinated Project for Dryland Agriculture was one of the Canadian International Development Agency's most successful projects in South-East Asia. It's focus was to develop management practices with emphasis on low cost inputs appropriate to a given area, so that a high level of productivity and agricultural stability could be achieved for dryland agriculture (Crop Life Saving Research 1976). Since water is often the limiting factor for agricultural production, the management of these resources is of extreme importance.

Because on-farm soil and water management is the key to successful management of water resources, a comprehensive watershed management approach was introduced. The approach consists of managing water where it falls, safely moving excess water off agricultural land without erosion, and storing the excess water for subsequent reuse. Many expensive flood control dams and reservoirs were constructed but soon became ineffective due to sedimentation resulting from erosion, particularly under severe monsoon conditions. As a result, watershed management research was introduced to develop on-farm management practices. Apart from erosion control, these practices provided an opportunity to stabilize and improve dryland agriculture production.

The All-India Co-ordinated Research Project for Dryland Agriculture was initiated in 1971 as a national project by the Indian Council of Agricultural Research (ICAR) with 23 centres in different parts of the country(Nicholaichuk,et al. 1979). Each center was encouraged to identify important problems and conduct the necessary research required for it's region. This approach kept the initiative and responsiblity with the scientist in the field. National co-ordination, in contrast to national direction, provided effective leadership and liason between research units in the field, thus avoiding unnecessary duplication of effort.

A major role for the Canadian Advisor was education and training. Training consisted of working with colleagues in India and training Indian scientists in Canada. Various techniques were used to educate and train Indian scientists to solve problems pertinent to the overall goals of the soil and water program of the project.

In most dryland agricultural areas of India, the loss of top-soil by erosion during the monsoon season and the lack of adequate storage of soil water were the main factors that affected dryland production and yield stability. A sound, comprehensive soil and water management program consisted not only of runoff collection, storage and utilization, but included tillage, cropping, soil management and water conservation practices. To achieve a desired level of productivity and yield stability, all aspects of soil and water management must be well integrated.

Generally, the problem was one of managing water and soil on a catchment basis by agronomic and physical land treatment methods. The questions were simply:

1. How to manage water where it falls?
2. How can excess water be moved off a farm field without causing erosion?
3. How should excess water be stored efficiently?
4. If stored in a reservoir, how can seepage and evaporation be reduced?
5. How can water be reintroduced to the land as a form of supplemental irrigation?
6. When, and how much water should be applied to optimize production and stabilize yield?
7. What crops should be grown to make the best use of the applied water?

As advisors, our efforts were focused on developing research to answer these questions.

Since the research needs varied with climate, soil conditions, etc., it was necessary to develop a research strategy appropriate to each area. To do so necessitated the development of a full understanding of the economic, institutional, agro-biological and physical influences of traditional farming systems.

One approach used was to visit various farms in the region to obtain a feel for the problem from a producer's perspective. Based on these visits, a general consensus of the magnitude of the problem and the range of possible solutions from the farmer's perspective was obtained.

Because the nature of the soil and water management problem was so complex, the solutions were equally complex. For example, how do you manage water where it falls? Solutions can be found in various agronomic practices and physical land-treatment practices or by a combination of them. As a result, solutions required the co-operative effort of various disciplines engaged in agricultural technology.

Interdisciplinary co-operation made it possible to take a 'holistic' approach to research. Since the problems envolved a complete integration and understanding of processes, it became necessary to consider the relationships between system components and the strengths and weaknesses of improved management practices. This approach created an opportunity for the involvement of a team of scientists to work together towards a common goal.

The role of an advisor then became that of a catalyst and instigator, thus allowing the research scientist to become creative in order to develop unique solutions to problems of soil and water management. In many cases, it became necessary to develop a package of practices geared to meet the farmer's resources and land capabilities.

One of the main problems experienced was the lag between what was possible and what was actually accomplished. This may be mainly attributed to the problem of communication. It is not likely that an individual farmer will move much to close the gap of communication with a Ph.D. scientist. The Ph.D. must make a greater effort to communicate with the farmer. The scientists should also spend a percentage

of their time in the field. In cases where this was done, the results were impressive. In some cases this was not done, and the results were as one would expect.

In addition to the development of appropriate technology at a research facility, there was a need to evaluate the technology when it was made available to a local farmer. The main emphasis at this stage was on education. It is often said "before a child can run, it has to learn to walk". The same applies to the transfer of technology.

Many earlier 'aid' projects failed in India due to a rapid infusion of modern technology that the Indian farmer could not comprehend. The technology must be introduced in small incremental steps in order to bring about a change. To this end, the concept of operational research was introduced. Through a combination of education and demonstration, new technology was presented and adapted to meet an individual farmer's resource capability. Operational research provided the scientist with an opportunity to observe first hand the strengths and weaknesses of management techniques as well as possible interactions.

To accomplish the foregoing required taking a research scientist from the bench to the field. With more than adequate facilities and resources at the disposal of scientists, it was possible to accomplish the informidable. However, in reality, the successful transfer of technology required its adaptation to meet local needs. In some cases, it became necessary to redivert research efforts to other problems created by the new technology.

The research scientist also had to become familiar with all aspects of the new technology in order to facilitate the transfer to both the extension worker as well as the farmer. It was necessary to simulate a real life situation in order to fully understand the concept of designing and implementing water managment practices that would prevent erosion. More specifically, the soil characteristics that could sustain non-erosive velocities of overland flow had to be determined.

Much of the research success was due to the philosophy that was adopted. Applying the same 'walk before you run' approach made it possible for the scientist to develop self confidence in problem identification and researching appropriate solutions. As we all know, research is somewhat of an iterative process in which knowledge can be described as a series of building blocks. The newly gained confidence allowed the scientist to become motivated to see 'research through'. The rewards often came from the end user of the results. For example, having a producer express his gratitude for a technology that allowed him to prosper rather than 'just survive' often provided a major boost in confidence to the scientist.

Another role for the advisor was to make things happen by 'cutting the red tape'. The bureaucracy at times was overwhelming. Depending on the research centre and its association with the local university, state or central government institutions, certain administrative procedures would often cause severe hardships to dedicated scientists trying to achieve their goals. Research progress is highly dependent on co-

operation and support from its administration. Often, in a large bureaucracy, there is a chain of command that must be strictly adhered to. The challenge was to modify administrative procedures to accommodate the needs of science. Very often, there is a reluctance on the part of the scientist to question the authority of administration. Encouraging scientists to deal with administrative difficulties very often resulted in improved research efficiencies.

Generally, the exceptional scientists assigned to the project were very well trained at universities abroad. However, this did create some difficulties in dealing with the immediate research needs within the country. To illustrate the problem, an Indian scientist received his Ph.D. at a very prominent university in North America. Upon returning to India, the scientist continued to work on an extension of his Ph.D. topic (which was not pertinent to the research needs of his country) and published his results in North American journals. The work was well done and well received in North America, but was irrevelant to the needs of the project.

The question that needs to be addressed is how to train personnel for a developing country. An approach worthwhile considering is one in which the student receives his or her formal technical training (course work) at a recognized university (often abroad) and undertakes a research project dealing with local issues. This research experience can often be acquired at an international research centre that specifically deals with more relevant research issues.

Another aspect is training of scientists in Canada. Under the terms of the agreement, Indian scientists could undertake short-term training at a Canadian research institution that would be relevant and pertinent to the overall goals of the project. In general, this aspect of the project was a worthwhile endeavour. Every effort was made to select appropriate candidates who would benefit the project. Unfortunately, the benefits were often short-lived. In many instances, scientific staff who received foreign training are recognized for their experiences and are promoted into other positions not tied to the project. As a result, the country as a whole benefits from this type of training, but not the project.

Finally, a comment on the aspect of 'third country visits'. This part of the project had provisions for an Indian scientist and his or her Canadian counterpart to visit first class research institutions anywhere in the world, provided the experience and knowledge gained could be employed in the work environment in their own respective countries. In theory, this aspect of the project was worthwhile provided that candidates met the following criteria:

1. Candidates were selected from a working group of scientists and would be in a position to utilize the knowledge and experience gained;

2. Candidates selected were either young scientists or in the early stage of career development so they would benefit from such visits;

3. Candidates would return to the project after completion of their training .

Unfortunately, recommended candidates were often replaced by: more senior bureaucrats or administrators who viewed third country visits as an opportunity for a 'world tour or holiday'; aging scientists or bureaucrats who were nearing the end of their professional career and would not be in a position to extend or share the knowledge gained; or individuals of higher rank. As a result of this experience, I would suggest that in future programs of this type, some assurance should be built into agreements so that the program can meet the original objectives.

OTHER EXPERIENCES

1. Sri Lanka

In Sri Lanka, a project similar to the All-India Co-ordinated Project for Dryland Agriculture was introduced(Nicholaichuk 1979). The main objective was to introduce a farming system to replace the 'slash and burn' agriculture that was being practiced. This would intensify and stabilize rainfed agriculture in the dry zone of Sri Lanka.

Although dryland farming conditions differed from India, the problems of soil and water management were similar to the more semi-humid and humid regions of India.

Based on a very short work experience in Sri Lanka, the following observations were made. Training and education of Sri Lanka's scientists was similar to those of India. The same model of utilizing Canadian advisors to work with their counterparts proved to work well. The bureaucratic infrastucture was kept to a minimum so that research efficiency increased.

As in India, parts of the project funds were dedicated to vists to other research institutions in both developed and underdeveloped countries. In contrast to India, scientists actively engaged in the project participated in the program. This resulted in a more direct benefit to the dryland agricultural project. Research activities focused on realistic goals that could be readily implemented.

2. Brazil

The planning of the Brazilian project was one of technical co-operation(Plan of Operation 1984). Although the emphasis of the project was tillage, solutions to practical problems of soil and water management were the focus. Research results had the potential benefit for both Canada and Brazil.

Brazilian staff were drawn from federal research institutions. Many of the research staff members were trained in North American and European universities. The education and training aspects of the project differed from experiences in Sri Lanka and India. Two types of training

programs were envisaged. They included on-the-job training and formal university training at the Ph.D. level.

On-the-job training of Brazilian researchers in Canada was designed to ensure comparable methods of conducting experiments in host countries and to increase the expertise for future research activities. Plans were to have Brazilian scientists become actively involved in the co-operative projects and gain experience with Canadian equipment, research techniques, data processing and analysis.

On the other hand, Canadian scientists would serve as consultants on co-operative projects in Brazil and would provide research guidance and answer day-to-day questions that arose during the course of the projects.

Advanced training of Brazilian scientists to the Ph.D. level was designed to meet the direct needs of the project. Since the research requirements were determined to meet the needs of both countries, it was logical the research results derived from the Ph.D. dissertation would also be of mutual benefit.

From the planning of the Brazilian project, the potential benefits from technical co-operation were considered invaluable. Because similar research was to be conducted simultaneously under two different soil and climatic conditions, research results could be extrapolated to a range of conditions.

SUMMARY

Based on experiences in India, Sri Lanka and Brazil, several models were used to accommodate the education and training needs. In project development, it is important to evaluate the quality of the human resource base that exists, keeping in mind that it is important to learn to walk before you can run.

The model used in the India project appeared to work very well. A core of technical advisors working with their Indian counterparts provided the leadership for the project. Although the counterparts had the technical training it was necessary to develop an approach to research that included the following:

- long-term and short-term objectives for a program,
- long term and short term goals with appropiate milestones and perfomance indicators,
- strategy to achieve both the long and short term objectives,
- an action plan designed to undertake specific areas of research.

To execute a research program the importance of interdisciplinary and integrated research must be stressed. In addition to conducting the research, there was also a need to communicate and verify the results. Taking the research to a realistic field situation for 'on-farm' evaluation was equally important.

Formal training was another area that needed to be addressed. It was recommended that advance research training to the Ph.D. level should provide an opportunity for the researcher to deal with local problems.

Short-term training should be geared to the working scientist who would benefit the most. Assurance should be given that a selected candidate would be allowed to accept the opportunity for third-country visits.

For advanced countries such as Brazil, the model of close technical co-operation is recommended. Potential benefits can be accrued to both the countries involved. Technical exchanges that permit working scientists to work on joint co-operative projects provide an opportunity for both countries to advance technically. Other programs such as joint space technology ventures have been shown to be successful.

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